Flutec Fluidtechnische Geräte GmbH, Industriegebiet,
66273 Sulzbach/Saar

A Device for Pumping Fluid

The invention relates to a device for pumping fluid, with a hydraulic pump and a drive mechanism, the hydraulic pump being an external gear pump and as an independent component capable of being coupled to various types of drive mechanisms as additional components in the manner of a building block system and for this reason is in the form of a one-piece coupling piece, various hydraulic tanks, especially ones with different tank capacities, being provided as a third type of component, a particular hydraulic tank on one side being connectible to the coupling piece and the particular drive mechanism on the other, opposite side being connectible to this the coupling piece, for which purpose the coupling piece on at least one side has a flange element, and sealing means being provided between coupling piece and drive mechanism as well as the hydraulic tank.

DE-A-195 14 749 describes a device for pumping fluid with a radial piston pump as hydraulic pump and a drive mechanism for driving the pump. The conventional device is likewise modular in structure in the manner of a building block system, the independent component forming with the radial piston pump a multipart element which is built correspondingly large axially so that the conventional pump device is on the whole large and so cannot be

used in every installation case, especially under cramped installation conditions. In addition, because of the large number of individual piston pump elements required for the radial piston pump, a certain degree of susceptibility to breakdowns in operation is natural. In view of the great variety of parts, production and use of the radial piston pump as a hydraulic pump are also expensive.

Such pump devices, which are also called pump assemblies, are used among other things for hoisting and also lowering loads by means of hydraulic mechanisms, for example, in the area of cargo platforms in trucks, automobile platform lifts, mobile elevating platforms, or the like. In the mobile motor vehicle area, in which frequently only battery power is available, direct-current motors are used as drive mechanisms, while in contrast, in the area of commercial firm installations or the like, where direct current is available, the relevant pump device with a rotary current motor is employed.

In the relevant conventional solutions (DE-U-296 01 201) a special assembly solution has been made available for each special application, one which meets the special operating requirements. Since an independent technical concept is to be made available for each application, the known solutions are expensive to apply in production, and a large number of different structural shapes and structural components must be stocked as a function of customer requirements.

As a further development of the concept of configuring pumping devices or pump assemblies as a modular building block system, DE-A-32 27 926 proposes providing a hydraulic unit with a flangelike base plate on one side surface of which is removably fastened a hydraulic pump along with a housing tightly enclosing the pump and serving as container for the hydraulic medium, and on the other side surface, mounted removably and opposite the pump, is an electric motor whose drive shaft extends perpendicularly to the two side surfaces. In the case of this conventional solution the hydraulic pump is a component of the hydraulic tank; this circumstance reduces the storage capacity. The flange-like base plate, in contrast, is provided with drill holes, perforations, or the like which form all the connecting lines required for mounting of various hydraulic pumps, motors, valves, control elements, or the like and end on one side or peripheral surface of the flange-like base plate, where fastening means for the components and for their connection are provided. The relevant conventional hydraulic unit as a pumping device is large in size and cannot be employed in every application if the space available for mounting is especially restricted.

DE-A-196 27 405 discloses a device for pumping fluid, one having the features specified in the preamble of Patent Claim 1. The conventional pump layout consists of a hydraulic tank with a filter and external gear pump which is connected by way of a drive shaft of an electric motor as drive mechanism to this electric motor. Hydraulic tank and electric motor are mounted on opposite sides of the pump housing, which serves as coupling piece, the electric motor engaging an annular recess in an end plate on an accompanying adjustable flange of this end plate, while the hydraulic tank is held in place by a clamp on a flange-like seating surface. As viewed along a

longitudinal section following the longitudinal axis of the pump layout, the pump housing is T-shaped in outline graduated through various widths. Replacement of the hydraulic tank on the side of the coupling piece with the drive mechanism is not possible, so that the possibility of adaptation to comply with stated customer wishes is restricted.

On the basis of this state of the art the invention has the object of further improving conventional devices for pumping a fluid so that the manufacturing costs and so overall costs are reduced and so that a large number of customer wishes can be satisfied with a small number of components. The invention also has the object of developing a reliably operating pump unit, without the need for reducing the capacity of a tank container, which may also be installed under extremely cramped installation conditions in order to conserve space and yet is just as efficient as a comparable product of the state of the art. An object such as this is attained by means of a device having the characteristics specified in Claim 1 in its entirety.

As a result of the circumstance that, as specified in the descriptive portion of Claim 1, the coupling piece is in the form of a base plate, that, on its side opposite the flange element, the coupling piece has another flange element which is adapted to the first flange element from the viewpoint of its external dimensions, that both flange elements have on their outer circumference a radial recess for engagement of a sealing means which may be overlapped by the free end of the hydraulic tank involved, and that the hydraulic tank involved and the drive mechanism involved may be connected while together on one side of the coupling element, it is possible to put

together a pump device as a compact unit for a large number of applications with the smallest possible number of components. In the process the components already available may be combined at will with each other in accordance with customer instructions to form a marketable unit. Hence the device claimed for the invention yields a building block system, equivalent parts being used to produced a large variety of different embodiments at a low cost level. In this instance the hydraulic tank may incorporate the drive mechanism and be mounted together with such drive mechanism on the side of the coupling piece provided for this purpose.

The hydraulic pump is incorporated and fully integrated into the base plate in the form of an external gear pump, so that the entire capacity of the tank unit to be connected is available. In addition, as a result of integration of the external gear pump the length of the fluid lines and control lines is reduced; such reduction is in keeping with the desire for reliability in operation with low pressure losses. The fact that the external gear pump has only two gears as actuating and drive element, this resulting in conservation of installation space and also being cost effective, also promotes reliability of operation. In addition, the external gear pump is easier to design on the basis of its volume throughput for a wide variety of applications, and it is easier to design the fuel pump on the basis of its geometric dimensions.

In addition, in the event of breakdown and for maintenance purposes, the hydraulic pump may be replaced simply by replacing the coupling piece; because of the platelike configuration of the coupling piece; because of the platelike configuration of the coupling piece, the hydraulic pump itself is easily accessible for purposes of repair and maintenance.

Additional embodiments of the device claimed for the invention are specified in the subsidiary claims.

In what follows the device for pumping fluid is described in greater detail on the basis of an embodiment illustrated in the accompanying drawing. In a basic illustration not drawn to scale,

Figures 1 to 3 show the pump device with various drive units, partly in a sectional view and partly in a side view;

Figures 4, 5, and 6 present a sectional view along lines I - I, II - II, and III - III corresponding to the presentation in figure 1.

The device presented in the figures is used for pumping and thus delivery of fluid by means of a hydraulic pump 10 which may be powered by a drive mechanism 12. The hydraulic pump 10 as an independent modular component may be coupled with various types of drive mechanisms 12 as additional components in the manner of a building block system and for this purpose is in the form of a coupling piece element 14 on the housing. A third type of component is represented by various hydraulic tanks 16, especially ones with different tank capacities, and the particular hydraulic tank 16 being connectible on one side to the coupling piece 14 and to a particular drive mechanism 12 on the other, opposite side (cf. figures 1 and 3) or on the same side (cf. figure 2) to the coupling piece 14. In the illustration in figures 1 to 3, essentially only one type of hydraulic tank 16 is shown, one which may be refilled with fluid, especially hydraulic fluid, by way of a refill connector 18.

In accordance with the embodiment shown as a hydraulic pump 10, the coupling piece 14 has a gear pump 20 as external gear pump with two meshing gears 22 as conveying means. The gears 22 of the gear pump 20 are mounted in a pump chamber 24 of the coupling piece 14 and are rotatably guided in bearing bushes (not shown) of the coupling piece 14.

The interior of a given connected hydraulic tank 16 is connected to the interior of the pump chamber 24 by way of a suction channel 26, specifically, at the point of transition to the coupling piece by way of a suction flange 28 (cf. figures 1 and 3). In the case of the building block alternative shown in figure 2, in which the drive mechanism 12 is integrated inside the hydraulic tank 16, the suction channel 26 may be omitted and fluid delivered directly by way of the suction flange 28, which in this instance is mounted on the drive mechanism 12.

Inside the coupling piece 14, there is present in the line of vision as shown in the figures a delivery line 30 extending vertically which connects the pump chamber 24 to the exterior while conducting fluid. On the free end of the delivery line 30 extending to the exterior this line is closed by a spring loaded return valve 32, which opens by overcoming the force of the spring as soon as the hydraulic pump 10 begins operating in order to supply a consuming device such as one in the form of a hoisting device for a platform lift, automotive platform hoist, or the like with pressurized liquid. As is shown in figures 4 to 6 in particular, a branch line 34 which is connected to a pressure protection mechanism (valve) not shown in order to protect the hydraulic system from pressure peaks as overload protection discharges transversely into the delivery line 30. As is shown in figures 4 and 6, the feed

opening of the intake flange 28 discharges only partly into the pump chamber 24 with gear pump 20.

The drive mechanism 12 used is an electric motor, especially a rotary current motor 36 as illustrated in figures 1 and 2, or a direct-current motor 38 as shown in figure 3. The rotary-current motor 36 in the illustration in figure 2 is mounted inside the hydraulic tank 16 and so is an integral part of the tank. The associated pump assembly with so-called suboil motor consequently occupies less structural space, and also reduces the amount of fluid available in the hydraulic tank 16. In an embodiment not shown a hydraulic drive would also be conceivable as drive mechanism 12. As is to be seen in figures 1 to 3, the coupling 14 has on its one free end a flange element 40 that can be overlapped by the free end of the particular hydraulic tank 16, sealing means 42 in the form of a sealing ring being mounted at the location of the pertinent overlap. On the opposite side the coupling piece 14 has another flange element 44, which, in a form of the nature of a cover, may be connected to the hydraulic pump and/or to the drive mechanism 12.

By its outer dimensions the additional flange element 44 is adapted to the flange element 40 and, like the flange element 40, provides on its outer circumference a radial recess 46 for contact of the sealing means 42, provided the tank 16 is mounted on the other flange element 44 as is shown in figure 2. The two flange elements 40, 44 have in the center an annular recess for insertion of the intake flange 28 or for introduction of the relevant drive line 48 of the drive mechanism 12. The drive mechanism 12 with its drive line 48 may thus be coupled to the hydraulic pump 10, a fluid seal 50 in the form of a ring seal being present, at least at the site of the drive line 48 inside the other

flange element 44. In this way a reliable fluid seal of the interior of the pump device from the exterior is achieved by use of the sealing means indicated.

As continuation of the modular building block system with various drive mechanisms 12, as viewed in the line of sight in the figures, a control mechanism (not shown) may be present on the top of the coupling piece 14, a mechanism which may be connected to the coupling piece 14 by way of boreholes 52. The relevant control mechanism may contain hydraulic control elements for delivery of fluid to the consuming device, as well as entire hydraulic control units. The individual components of the modular pump assembly may be connected to each other by conventional screw connections. Since the hydraulic element 16 represents a closed structural unit, the pump assembly is operated as a closed system, that is, only the fluid content of the hydraulic tank 16 is used to supply a consuming device to be actuated. Since the fluid conducting lines are integrated into the coupling piece 14, in contrast to conventional solutions no separate sealing or piping is necessary. In particular, the flange elements may be ideally produced in a cost effective manner from cast elements. The drive mechanisms 12 in question may be represented by external elements and the material embodiment of the tank 16 may be of plastic or sheet steel. The embodiment of the gear pump 20 itself may be pressure compensated or not pressure compensated.

The gear pump 20 proper with its external gears 22 lies, as viewed in the direction of sight in the figures, together with the feed line 30, in a central plane extending vertically of the flange-like coupling piece 14, and the drive shafts for the gears 22 lie, together with the longitudinal axes of the drive line 48, in planes transverse to the longitudinal center plane in question, which is represented by line II - II in figure 1 (cf. figure 5). The free end of the drive

line 48 may be in form like a connecting pin which is engaged in a recess 54 in the cylindrical drive element 56 for one of the two gears 22, it being possible for only one gear 22 to be driven in this way by the drive line 48, and the gear 22 driven in this manner entrains the other gear 22 for a pumping process by corresponding meshing of the two sets of gear teeth.

With the device claimed for the invention, the coupling piece 14 as hydraulic pump 10 is the central structural unit, which may be coupled at will to hydraulic tanks 16, drive mechanisms 12, and to control mechanisms not shown, as well as to consuming devices, to form a system solution. The coupling piece 14 is in the form of an integral solid base plate element like a mounting plate penetrated only by the feed and control lines referred to and by the gear elements of the gear pump 20. The gears 22 of the external gear pump 20 are mounted more or less in the center of the solid base plate of the coupling piece 14, so that a low-vibration drive is obtained during operation, and this condition promotes achievement of continuous feed of a stream of fluid.